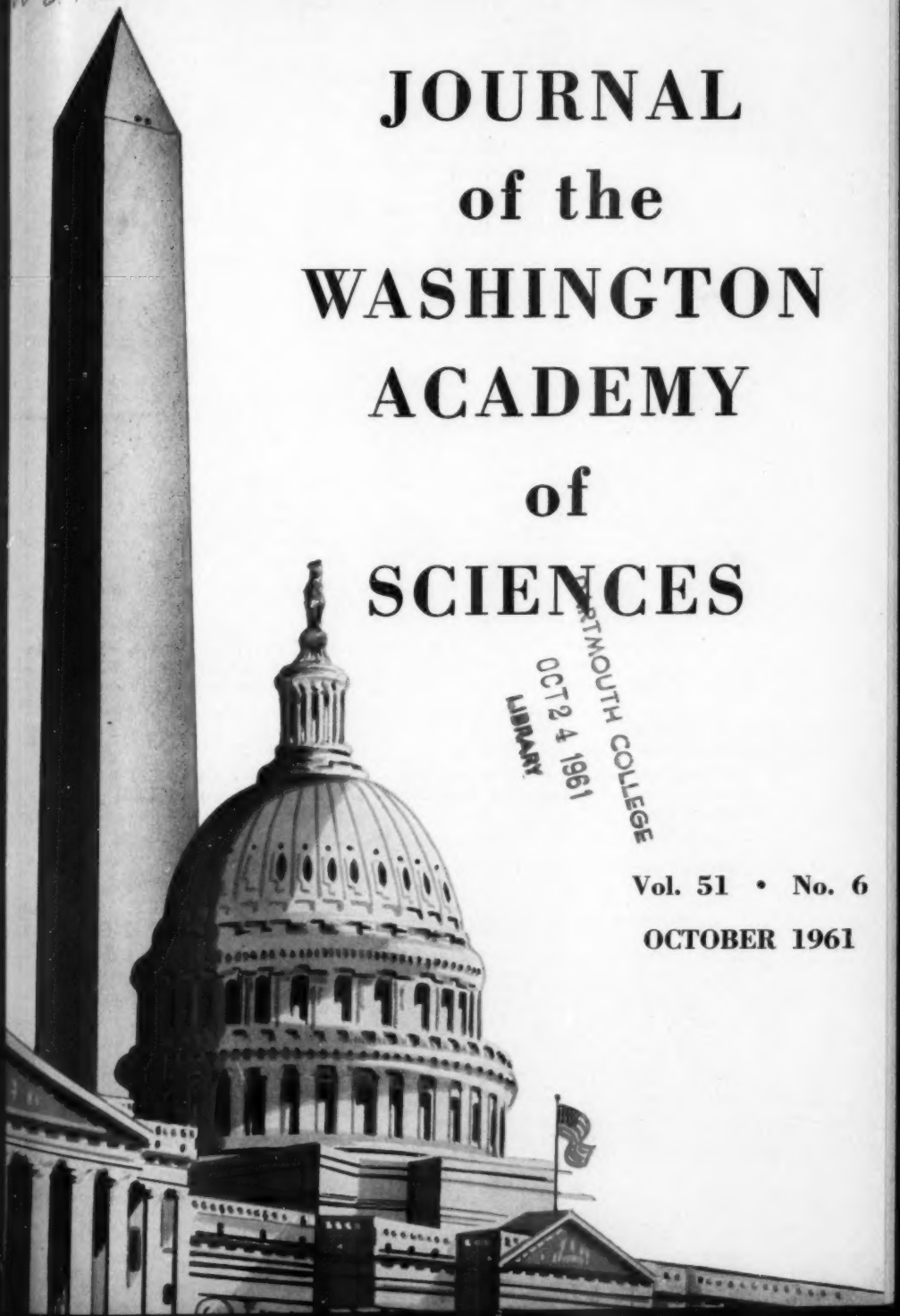
506
W277J

JOURNAL of the WASHINGTON ACADEMY of SCIENCES



DARTMOUTH COLLEGE
OCT 24 1961
LIBRARY

Vol. 51 • No. 6

OCTOBER 1961

JOURNAL OF THE WASHINGTON ACADEMY OF SCIENCES

Editor: SAMUEL B. DETWILER, JR., Department of Agriculture

Associate Editors

FRANK L. CAMPBELL, National Academy of Sciences
RUSSELL B. STEVENS, George Washington University
HAROLD T. COOK, Department of Agriculture
JOHN K. TAYLOR, National Bureau of Standards
LAWRENCE A. WOOD, National Bureau of Standards

Staff Assistant

RICHARD P. FARROW, National Canners Association

Contributors

ALBERT M. STONE, Applied Physics Laboratory
JOHN A. O'BRIEN, JR., Catholic University
ELLIOTT B. ROBERTS, Coast & Geodetic Survey
MARGARET D. FOSTER, Geological Survey
RUSSELL B. STEVENS, George Washington University
MODDIE D. TAYLOR, Howard University
FRANK L. CAMPBELL, NAS-NRC
ALPHONSE F. FORZIATI, National Bureau of Standards
HOWARD W. BOND, National Institutes of Health
ILEEN E. STEWART, National Science Foundation
ALLEN L. ALEXANDER, Naval Research Laboratory
VICTOR R. BOSWELL, USDA, Beltsville
HAROLD T. COOK, USDA, Washington
WILLIAM J. BAILEY, University of Maryland

This Journal, the official organ of the Washington Academy of Sciences, publishes historical articles, critical reviews, and scholarly scientific articles; notices of meetings and abstract proceedings of meetings of the Academy and its affiliated societies; and regional news items, including personal news, of interest to the entire membership. The Journal appears eight times a year in January to May and October to December.

Subscription rate: $7.50 per year (U.S.), $1.00 per copy. Foreign postage extra.

Subscription Orders or requests for back numbers or volumes of the Journal, or copies of the Proceedings, should be sent to the Washington Academy of Sciences, 1530 P St., N.W., Washington, D.C. Remittances should be made payable to "Washington Academy of Sciences".

Claims for missing numbers will not be allowed if received more than 60 days after date of mailing plus time normally required for postal delivery and claim. No claims will be allowed because of failure to notify the Academy of a change of address.

Changes of address should be sent promptly to the Academy Office, 1530 P St., N.W., Washington, D. C. Such notification should include both old and new addresses and postal zone number, if any.

Advertising rates may be obtained from the Editor, care of Academy Office.

Second class postage paid at Washington, D. C.

OFFICERS OF THE WASHINGTON ACADEMY OF SCIENCES

President: PHILIP H. ABELSON, Geophysical Laboratory
President-Elect: BENJAMIN D. VAN EVERA, George Washington University
Secretary: HEINZ SPECHT, National Institutes of Health
Treasurer: NORMAN F. BRAATEN, Coast and Geodetic Survey

Some Symbiotic Relations Between Saproglyphid Mites And Solitary Vespid Wasps*

(Acarina, Saproglyphidae and Hymenoptera, Vespidae)

Karl V. Krombein

Entomology Research Division, U. S. Department of Agriculture

Several families of mites contain species that are parasites of solitary wasps and bees. Some of these mites, such as several species of *Pyemotes* (Trombidiformes, Pyemotidae), kill and feed on the more or less helpless immature stages of many insects. Other species belonging to the genera *Lackerbaueria, Tortonia,* and *Horstia* (Sarcoptiformes, Acaridae) or *Chaetodactylus* (Sarcoptiformes, Chaetodactylidae), have as host one or only a few species of solitary wasps or bees. Usually the adult mites belonging to these genera kill the host egg or larva and then develop and multiply as scavengers on the food stored by the mother wasp or bee. However, in at least one other family, species belonging to genera such as *Vespacarus, Monobiacarus, Ensliniella,* and *Kennethiella* (Sarcoptiformes, Saproglyphidae) have developed a very complex symbiotic relation with solitary wasps of the family Vespidae. The saproglyphid mites are nearly always host specific, each mite species occurring on only one species of vespid wasp.

I have observed the life history of some saproglyphid mites during my studies of the solitary wasps that can be induced to nest in borings in wooden sticks. These artificial nesting sites are made in sticks of straight-grained pine ¾ by ¾ by 6½ inches. A boring 6 inches long having a diameter of $^3/_{16}$, ¼, or ½ inch is drilled in each of the sticks. The traps are made up into bundles of six, each containing one or two borings of each diameter. The bundles are set out horizontally in situations where wood-nesting solitary wasps are likely to search for nesting sites. Since vespid wasps do not gnaw out borings but merely take over abandoned borings of some other insect, usually those of beetles, these traps offer very desirable nesting sites. The most productive settings are on sound dead trunks or limbs containing abandoned beetle borings or on exterior structural timber containing similar borings. After completion the nest may be brought into the laboratory, split open, and observations made on the life history of the occupants.

Life History of the Host Vespid Wasps

Species of *Stenodynerus* subg. *Parancistrocerus, Ancistrocerus,* and *Monobia* serve as hosts of *Vespacarus, Kennethiella,* and *Monobiacarus.* These wasps are similar in the main details of their life history. The female selects a boring of suitable diameter, $^3/_{16}$ or ¼ inch for *Stenodynerus* and *Ancistrocerus,* ½ inch for *Monobia.* She suspends her sausage-shaped egg by a slender thread from the ceiling of the boring near the inner end. Then she hunts for a caterpillar, paralyzes it by stinging, and flies with it to the nest. This caterpillar is stuffed into the inner end of the boring, and the wasp departs to hunt another. This process continues until about six to eight caterpillars have been stored. Then the wasp constructs a partition of agglutinated sand grains or mud several millimeters

* Adapted from an address before the Entomological Society of Washington, March 2, 1961.

1
2
3
4
5
6

thick across the boring, to seal off that cell. Then another cell is stored, and so forth, until the boring is filled with a linear series of 4 to 10 cells. Frequently the wasp builds an empty vestibular cell between the last stored cell and the outer end of the boring, and sometimes, as in *Monobia*, she may build an empty intercalary cell between each of the stored cells.

The egg hatches in from two to four days and the legless, maggot-like larva devours in four to seven days all of the caterpillars stored for it. The mature larva spins a delicate silken cocoon which completely encloses the larva in *Stenodynerus* and *Ancistrocerus*, and consists of just a vestigial cap in *Monobia*. The meconium (accumulated fecal wastes) is voided into the posterior end of the cocoon, and the larva becomes a quiescent resting form. In the summer generation or generations pupation occurs four to seven days after completion of the cocoon, but in the overwintering generation the wasp overwinters as a diapausing larva and transforms into a pupa the following spring. The pupal stage lasts 10 to 17 days. After casting the pupal exuvia, the adult remains in the cell several days while the integument hardens. The wasps then chew through the cell partitions, leave the nest, mate, and begin another reproductive cycle.

The Acarinarium

The hypopi (resting stage) of saproglyphid mites occupy a specialized area called an acarinarium (fig. 1) on or in the body of the adult vespid wasps. The hypopi (fig. 2) cluster on or in this area in regular, shingled rows and attach to the host or to each other by a ventral suctorial plate on the apex of the abdomen. The acarinarium may consist of just the flattened, polished lateral and posterior surfaces of the propodeum (hind part of the thorax) as in *Ancistrocerus antilope* which has as its symbiont *Kennethiella trisetosa*. Or, the mites may cluster on the ventral side of the apical margin of one or more of the apical abdominal terga as does *Vespacarus tigris*, the symbiont of *Ancistrocerus tigris*. Or, there may be a definite internal chamber as in *Stenodynerus* subg. *Parancistrocerus* and *Monobia* which harbor other species of *Vespacarus* and *Monobiacarus*. This chamber is formed by the depressed anterior part of the second abdominal tergum which is normally covered by the apex of the first tergum except when the abdomen is flexed downward.

Life History of the Saproglyphid Mites

The developmental stages of the mites consist of the egg, a six-legged larva, an eight-legged first nymph or protonymph, an eight-legged second or deutonymph usually called the hypopus in sarcoptiform mites, an eight-legged third or tritonymph, and adult females and males. The larva, protonymph, tritonymph, and adult have functional mouthparts. The deutonymph (hypopus) is a resting stage; it lacks mouthparts and has a suctorial plate on the venter of the abdomen by which it attaches to the adult host.

The mites are much smaller than the host wasps. Most *Stenodynerus* adults normally range from 8 to 12mm. in length. The hypopi of various species of *Vespacarus*, the parasites of *Stenodynerus*, range from 215 to 275μ in length; adult males may be 320 to 530μ long and gravid females from 530 to 815μ. *Monobia* is a larger wasp, adults usually measuring 15 to 20 mm. in length. Its parasite, *Monobiacarus*, has hypopi only 250μ long, but the adults are veritable giants, the male being 770μ and gravid females 1150 to 1450μ in length.

Figure 1.—*Stenodynerus (Parancistrocerus) saecularis rufulus* (mites have been removed from right half of acarinarium at base of second abdominal segment), 10X. Figure 2.—*Vespacarus saecularis* hypopus, ventral aspect, the symbiont of *Stenodynerus saecularis rufulus*, 106X. Figures 3-6.—*Stenodynerus (Parancistrocerus) fulvipes fulvipes* and its mite, *Vespacarus fulvipes*. Figure 3.—Young pupa with several gravid female mites and a few eggs, 7X. Figure 4.—Gravid female mite and eggs on head of pupa, 17X. Figure 5.—Mite eggs on head of pupa, 17X. Figure 6.—Mite nymphs on head of pupa, 24X. *(Drawings by Arthur D. Cushman, photographs by the author.)*

As in any successful symbiotic relation, the mite has adjusted its developmental cycle perfectly to that of the host wasp. The rhythmic pulsation of the wasp's abdomen during movement of the egg from the oviduct prior to oviposition may be the signal for as many as 20 hypopi to leave the wasp's body and drop off in the cell. Transformation of the mites to the tritonymphal and adult stages takes place in the interval of a few days between oviposition by the wasp and completion of feeding by the wasp larvae. The adult mites are on the wasp larva as it begins to spin, and they are enclosed in the finished cocoon. They begin to feed on the wasp larva as soon as it has voided the meconium and has assumed the quiescent form. In heavy infestations by saproglyphid mites the resting wasp larva is literally peppered with tiny black feeding punctures. However, I have never observed that this feeding is injurious to the wasp.

The engorged adult female mite ceases feeding and begins to lay eggs as soon as the wasp transforms to the pupal stage (figs. 3-4). Since the period between voiding of the meconium and pupation may be only several days for the summer generations to a number of months for the overwintering generation, it is necessary to postulate some factor in the wasp's development that initiates ovulation in the female mite. It seems most probable that this factor may be the cessation in production of the juvenile hormone at the time when the wasp pupa begins to develop within the last larval skin. The growth and differentiation hormone present in the body fluids of the wasp during this developmental period may then stimulate ovulation in the female mite when she feeds on these fluids.

The mite eggs are ovoid (fig. 5), those of *Vespacarus* being 150-170μ long and 90-110μ wide, and those of *Monobiacarus* about 200x100μ. The species of *Vespacarus* deposit their eggs around the mouthparts and legs of the newly transformed wasp pupa, whereas *Monobiacarus* lays its eggs on the cell walls and partitions. A gravid female mite may lay up to 20 eggs over a period of 10 to 15 days.

The six-legged larvae of *Vespacarus* hatch 6 to 15 days after oviposition, depending on nest temperatures. They are slightly larger than the eggs, ranging from 125-200μ long and 55-155μ wide, and have an ovoid shape. The larvae transform to eight-legged protonymphs (fig. 6) in less than 2 days. These nymphs are larger than the larvae, ovoid in shape, and range from 250-300μ long and 150-165μ wide. Both the larvae and protonymphs wander more or less freely over the body of the pupa.

Most of the mites are in the protonymphal stage when the adult wasp is ready to shed the pupal exuvia, about 17 to 21 days after pupation occurs. As eclosion draws near, the mites cluster on the venter of the wasp around the mouthparts and legs. They are shed along with the pupal exuvia, and in a very brief time transform to the deutonymphal state (hypopus). The hypopus (fig.2) has an oval, flattened, more sclerotized body. Those of *Vespacarus* range from 215 to 320μ in length.

The *Vespacarus* hypopi soon leave the pupal exuvia, clamber on to the tip of the wasp's abdomen, and crawl forward on the dorsum until they reach the apical margin of the depressed acarinarium at the base of the second abdominal segment. Then the hypopi turn around and back into the acarinarium. As additional hypopi perform this same maneuver they come to lie in shingled rows until the acarinarium is full. The mites are then ready to infest a new nest if they happen to be on a female instead of a male wasp.

The mite *Kennethiella trisetosa* has a more complex relationship with its host, *Ancistrocerus antilope* *. The female wasp larva eats the adult mites in the cell with it before spining a cocoon, but the male wasp does not harm the mites in its cell. Consequently, when the adult wasps leave the nests only the males are infested with hy-

* Cooper, K. W. "Venereal Transmission of Mites by Wasps, and Some Evolutionary Problems Arising from the Remarkable Association of *Ensliniella trisetosa* with the Wasp *Ancistrocerus antilope*." Trans. Amer. Ent. Soc. **80**, 119-174 (1955).

popi which cluster on the hind part of the thorax instead of in a specialized internal chamber. When an infested male wasp mates with a female, some of these mites stream down the abdomen of the male and enter the genital chamber of the female, from whence they can infest each cell as the egg is laid.

Academy Membership Increase Urged

Mary L. Robbins

Chairman, WAS Committee on Membership.

The Washington Academy of Sciences is the only organization which can speak and act for the entire metropolitan scientific community. To enable the Academy to realize its potential for service, its membership must be increased. At present its members represent only a fraction of those eligible in the area. As one way of reaching this large group of scientists, the Committee on Membership is appealing to each member of the Academy to recommend for membership those of his colleagues whom he considers to be eligible.

The current criteria for eligibility for membership represent the Committee's interpretation of the Bylaw reading, "Active members shall be persons who by reason of original research or scientific attainment are deemed worthy of the honor of election."

To meet the requirement for original research, a candidate must have had several years' experience and achieved recognition in a scientific field. A younger nominee must have a doctorate degree and several original contributions in addition to his thesis.

To meet the requirement of scientific attainment, a candidate must be (1) an administrator of a scientific program who has achieved recognition in the direct administration of the conduct of research; (2) a person who has achieved recognition as a distinguished editor or leader in science; (3) a teacher of science who has achieved an outstanding record in the teaching of science students or in behalf of the science teaching professions; or (4) a person who has demonstrated leadership in a society affiliated with the Academy, as evidenced by election to office, particularly to the presidency, of such a society. A nominee for election in any of these four categories must have shown a satisfactory degree of creativity or productivity.

In order to acquaint every member with the process by which a nominee is elected, the procedures are outlined below, followed by the sections of Article II of the Bylaws which pertain to election of members.

The Committee on Membership sincerely hopes that, with the aid of every active member, a very significant increase in membership in the Washington Academy of Sciences will be achieved.

Procedures for Election of Members to the Washington Academy of Sciences

1. a. A nomination, prepared on the official nomination form, is endorsed by (usually) three members of the Academy (one "sponsor" and at least one, usually

two, "endorsers"). At least one sponsor must have knowledge of the nominee's field.

b. With the exception of the citation, the form may be filled out by the nominee.

c. The citation must be prepared by one of the sponsors, who may receive advice from other members of the Academy if he wishes.

2. The nomination, with supporting material, is submitted to the chairman of the Committee on Membership.

3. The chairman submits the nomination to the chairman of the appropriate panel for consideration and recommendation. The panels, each consisting of five members including the panel chairman, are as follows:

a. Agricultural Sciences
b. Chemistry
c. Earth Sciences
d. General Biology
e. Mathematical Sciences
f. Medical Sciences
g. Physics and Astronomy
(h. A panel on Engineering is in the process of establishment.)

If a nomination does not fit any of the categories represented by the panels, it is submitted directly to the Committee on Membership.

All members of the panel, including the chairman, vote on a nomination.

4. After consideration by the panel, the nomination is returned to the committee chairman with the recommendation of the panel.

5. a. If the nomination is approved by the panel, it is then presented to the Committee on Membership (usually represented by the chairmen of the various panels) for consideration and recommendation. Each member present at the meeting votes for or against recommending the nominee for election. The chairman votes only in case of a tie.

b. If the panel recommends against election, the chairman of the Committee contacts the sponsor to give him an opportunity to withdraw the nomination. If the sponsor elects not to withdraw the nomination, he may submit it directly to the Board of Managers of the Academy.

c. If the panel is unable to reach a decision, the nomination is submitted to the Committee on Membership for consideration and recommendation as in 5 a above.

6. a. If the nomination is approved by the Committee on Membership, it is presented to the Board of Managers by the chairman of the Committee (the so-called "First Reading").

b. If the nomination is not approved by the Committee on Membership, the procedure outlined in 5 b above is followed.

7. At least one week after receiving the nomination (usually at the next monthly meeting), the Board of Managers votes for or against election of the nominee. Three-fourths of the votes cast must be in favor of election.

8. a. The secretary of the Academy notifies the nominee of his election and informs him that formal membership is attained after payment of the appropriate portion of the annual dues for the current year. Election becomes void if the person elected does not pay the dues within three months, or satisfactorily explain his failure to do so.

b. If a nominee is rejected by the Board of Managers, the secretary notifies the sponsor and informs him that a rejected candidate is not eligible for re-nomination within one year from the date of rejection.

9. Upon receipt of the dues, the secretary sends the new member the certificate of membership in the Washington Academy of Sciences.

Bylaws of the Washington Academy of Sciences

Article II—Membership (Sections 1 through 4 only)

Section 1. The membership shall consist of three general classes: active members (including those in life and emeritus status), honorary members, and patrons.

Section 2. Nominations for active membership shall be presented in writing at a meeting of the Board of Managers, each endorsed by at least two members of the Academy, one of whom shall have knowledge of the nominee's field. They shall be accompanied by a statement of the qualifications of the nominee and a list of his more important scientific publications and activities.

Section 3. Election to active membership shall be by vote of the Board of Managers. Final action on nominations shall be deferred at least one week after presentation to the Board and three-fourths of the vote cast shall be necessary to elect. An election to active membership shall be void if the person elected does not within three months thereafter pay his dues or satisfactorily explain his failure to do so.

Section 4. Active members shall be persons who by reason of original research or scientific attainment are deemed worthy of the honor of election to Academy membership. They shall be classed as resident and non-resident, those living within 25 miles of the White House, Washington, D. C., being considered resident members. The number of active members shall not exceed 1500, of whom not more than 1200 shall be resident members, provided that non-resident may become resident members regardless of this limitation.

What Is the Best Value?

William J. Youden

National Bureau of Standards

The accurate measurement of physical constants is a challenging and exacting task. To that end, the investigator directs his skills to the refinement of his apparatus and to the detection and elimination of sources of error in his measurements. Preoccupation with these endeavors may make it necessary to discard many measurements, otherwise the average will not truly represent the situation. The kind of problem that may arise will be illustrated by a hypothetical investigation of the gravity constant, g. For simplicity, assume that g will be estimated from measurements made with a falling object.

Let us assume that the falling object is a vertical rod with three lines engraved on it, and that the distances between these lines have been carefully measured. The time intervals required for these lines to pass a given point are now measured. We may suppose that a multitude of precautions have been taken and that repeated drops have been recorded. Let us also assume that the experimenter is fortunate in possessing a second rod. Careful measurements on this second rod show that the distances between the lines on this rod are slightly different from those on the first rod. Nevertheless, when allowance is made for the values of the distances in the calculations, the average value for g obtained with the second rod should check the average value for g obtained with the first rod. For the sake of argument let the two averages, each based on the same number of drops, differ substantially more than is compatible with the precision of the measurements. The precision is based on measurements made with the same rod and apparently there is no difference in the two estimates of the precision. No change in the apparatus has been made other than the substitution of one rod for the other, therefore the difference in the two estimates for g may be ascribed to small uncertainties in the values assigned to the distances between the lines on the rods.

We now have two values for g, and no reason to believe that the distances on

one rod are more accurately known than the distances on the other rod. The obvious and proper "best" estimate for g, from these data, is obtained by "splitting the difference", i.e., taking the average of the two estimates, giving equal weight to the value obtained with each rod. This is an important rule and it should be adhered to in obtaining the best value from a collection of data.

Suppose that the investigator is indeed fortunate in that he also has available a second clock for measuring the time for the drop. For convenience, designate the two rods by R and r and the two clocks by C and c. There is a well-established practice of changing but one variable at a time, because this is the obvious way to detect the effect of changing a variable. Obvious it may be but, as we will see, it is usually not the best way. The experimenter may or may not change back to the first rod while he tries a third series of drops with the second clock. It really does not matter in this case, and we list the symbols that are associated with the three series of measurements.

First series of drops	RC
Second " " "	rC
Third " " "	Rc

Let the average for clock C differ from the average for clock c, the same rod being used, just as different averages were obtained for the two rods, using the same clock. The problem confronting the experimenter now is to compute an average that will give equal weight to the two clocks and also give equal weight to the two rods. Try as you may you will find no alternative to taking the average of the second and third series. (If the third series had been rc, the first and third series should be taken for the average. One series has to be discarded, in either event.) We presume that changing clocks or rods does have a small effect on the result. Indeed, the averages for the series are most unlikely to be identical and some averaging process is appropriate. The investigation affords an estimate of the effect of changing a variable by taking the difference between the firs and second series for the rods and betwee the first and third series for the clocks. The best *average* to report is the averag of the second and third series. These tw series clearly give equal weight to both rods and both clocks.

We now point out that if the fourth possible combination, rc, is also run as a series, the amount of information is doubled in all respects. Let the average for a series be denoted by the symbols identifying the series.

$$\text{Effect of rod change } \frac{RC + Rc}{2} - \frac{rC + rc}{2}$$

$$\text{Effect of clock change } \frac{RC + rC}{2} - \frac{Rc + rc}{2}$$

$$\text{Best average } \frac{RC + rc + Rc + Cr}{4}$$

Here the effect of changing a variable is obtained by taking the difference between averages of two series, and the best average is the average of all *four* series.

The complications increase if a third variable is studied for a possible effect upon the results. In this hypothetical case, we propose that two observers, O and o, share the burden of making the measurements. There are now three variables to program. Listed below are three alternative schedules for making the measurements. In Schedule I only one variable is changed at a time. After the second series of drops has been made, the changed variable is restored to its initial condition and another variable changed. In Schedule II, once a variable has been changed it is left at its new value and a change made in some other variable. Finally, in Schedule III each series differs from the initial series in that *two* variables are changed together.

Series	Schedule I	Schedule II	Schedule III
1	ROC	ROC	ROC
2	ROc	ROc	Roc
3	RoC	Roc	roC
4	rOC	roc	rOc

We will now examine the three schedules with particular attention to obtaining a best

average of the data. The presumption is that there is nothing to guide one in choosing between rods, or between observers or between clocks. So the "best" value should give equal weight to the results obtained with the two rods, with the two observers, and with the two clocks.

Schedule I comes off very badly indeed. Denote the result obtained by any series by the identifying symbols. The best averages are:

$$\text{For Schedule I} \quad \frac{ROc + RoC + rOC - ROC}{2}$$

$$\text{For Schedule II} \quad \frac{ROC + roc}{2}$$

$$\text{For Schedule III} \quad \frac{ROC + Roc + roC + rOc}{4}$$

The governing rule is that there must be equal numbers of capital and lower case for each letter *after* the summation in the numerator is accomplished. Thus Schedule I suffers severely from the necessary subtraction of the result obtained with *ROC*. Although after the subtraction, the numerator is equivalent to the sum of just two series, the errors of all four series are involved. The net result is that this average best value has the same precision as the result from just one series. Schedule II permits an average of two series and the random error of a single series is consequently divided by $\sqrt{2}$. Two of the series do not contribute at all to the best average. Schedule III provides a best value that is a straight average of all four series, cutting in half the random error of a single series.

Schedules I and II are both inferior to Schedule III in detecting the effect of changing any one of the variables. The effect of changing a variable for the first two schedules is revealed by taking the difference between just two of the series. Thus the effect of changing clocks is given by the difference between the *ROC* result and the *ROc* result. Such a difference has $\sqrt{2}$ times the error of the result for a single series. Schedule III makes it possible to examine the effect of changing clocks by comparing averages of two series. The difference between

$$\frac{ROC + roC}{2} \quad \text{and} \quad \frac{Roc + rOc}{2}$$

gives the effect of changing clocks. Scrutiny shows that the two series with clock *C* involve both rods and both observers. The same relation holds for the two series with clock *c*. Consequently, these averages provide an unbiased comparison of the clocks. The standard error associated with this difference between these averages is simply the standard error for a single series. In summary, Schedule III yields twice as much information for the same number of measurements as does Schedule II, and has an even greater advantage over Schedule I.

The importance of keeping in mind the computations necessary to get the proper and best estimate of the average, when two or more variables have been examined, can hardly be exaggerated. Imagine that the two observers follow Schedule I and mistakenly take the simple average of the four series as their estimate of the best value. Now suppose that these same two observers repeat the study using the identical apparatus, but that they now follow Schedule II because it avoids restoring a variable once it has been changed. The simple average for Schedule II will not converge on the average obtained using Schedule I. For example, three of the series in Schedule I were made with clock *C*, whereas in Schedule II, three of the series were made with clock *c*. If there is a difference between clocks, this biases the overall averages. Rarely will the clocks be identical.

The averages for the three schedules, if computed by the correct formulas given above, will all converge upon the same value. It is a fact, given a particular system with certain choices available for the variables, that there should be one value and just one correct value associated with the system. The correct formulas that do estimate this one value show that Schedule III has at least a two-fold advantage over the more traditional Schedules I or II.

Science in Washington

SCIENTISTS IN THE NEWS

This column presents brief items concerning the activities of members of the Academy. Such items may include notices of talks given, important conferences or visits, promotions, awards, election to membership or office in scientific and technical societies, appointment to technical committees, civic activities, and marriages, births, and other family news. Formal contributors are assigned for the systematic collection of news at institutions employing considerable numbers of Academy members (see list on masthead). However, for the bulk of the membership, we must rely on individuals to send us news concerning themselves and their friends. Contributions may be addressed to Harold T. Cook, Associate Editor, U. S. Department of Agriculture, Agricultural Marketing Service, Room 2628 South Building, Washington 25, D. C.

APPLIED PHYSICS LABORATORY

A. M. Stone gave a talk on "Plasma Dynamics Research" on May 18, before U. S. Naval Research Ordnance Company 5-11, at the Naval Ordnance Laboratory, White Oak, Md. Dr. Stone is technical assistant to the director at APL. He also gave a lecture on "Thermonuclear Plasmas" to the Naval Air Reserve Training Unit at Anacostia Air Station on May 6.

R. E. Gibson, director, addressed the American Institute of Chemists on "The Systems Approach to Research Management," in Washington on April 11. Dr. Gibson also gave a lecture at Omaha, Neb., on May 4, on "Social and Economic Effects of Scientific Progress" to the Conference for Executives of Employment Security Agencies. On May 24 he addressed the Maryland Science-Industry Conference (convened by Gov. J. Millard Tawes) on "What Maryland Offers Science Industries."

A prize of $250 will be awarded to **Archie I. Mahan** and **L. P. Bone** for the winning paper entitled, "Far-Field Diffraction Properties of a Plane-Parallel Plate When Placed Partially in Front of a Rectangular Diffracting Aperture." The award will be presented at the meeting of the Optical Society of America, October 18-20, at the Hotel Biltmore in Los Angeles. Dr. Mahan is a senior staff physicist and Mr. Bone an associate mathematician at APL.

Alfred J. Zmuda was appointed to the Panel on the World Magnetic Survey, a panel of the Geophysics Research Board of the National Academy of Sciences.

COAST AND GEODETIC SURVEY

Donald A. Rice, chief of the Gravity and Astronomy Branch, Geodesy Division, attended the Symposium on Gravity Reductions held by the International Association of Geodesy at Cambridge, England, July 24-28.

Dean S. Carder was elected president of the Seismological Society of America, at a recent meeting of that Society.

A paper by **Dean S. Carder** and **W. V. Mickey** entitled "Ground Effects from Underground Explosions" has been accepted for publication in the *Bulletin* of the Seismological Society of America.

Elliott B. Roberts, assistant director for research and development, **Charles A. Whitten,** chief of the Triangulation Branch, Geodesy Division, and **Dean S. Carder,** chief seismologist of the Geophysics Division, were delegates to the 7th General Assembly of PAIGH and the 9th Pan American Consultation on Cartography, held in Buenos Aires August 1-15. Captain Roberts also attended the 10th Pacific Science Congress at the University of Hawaii, August 21 to September 6.

HARRIS RESEARCH LABORATORIES

Alfred E. Brown, president and director of research, presented a paper entitled "Physical, Chemical and Mechanical Properties of Protein Fibers" before the Protein Fiber Symposium at the 19th annual meeting of the Electron Microscope Society of America, held in Pittsburgh, August 23.

HOWARD UNIVERSITY

Stewart R. Cooper, professor of analytica chemistry, retired last June. Dr. Cooper is teaching half-time during the current year.

Lloyd N. Ferguson, professor and Department head, is spending his sabbatical year at the Swiss Federal Institute of Technology as a National Science Foundation faculty fellow in the laboratory of Professor V. Prelog.

Joseph B. Morris has been promoted from assistant professor to associate professor.

Moddie D. Taylor, professor, has returned from a year's special leave. He was a Robert A. Welch Foundation visiting scholar at Prairie View (Tex.) A&M College during the past academic year. During the summer he served as co-editor of "Teachers Guide for Chemical Study." Dr. Taylor is acting head of the Chemistry Department this year.

NAS-NRC

Paul D. Foote, executive secretary of the NAS-NRC panels advisory to the National Bureau of Standards, was awarded an honorary D.S. degree by Western Reserve University on June 14.

John S. Coleman has taken the lead in staff work at NAS-NRC for the Natural Resources Research Study requested last spring by President Kennedy. The study is now concerned with a comprehensive review of the problems and programs of eight major areas, including water, energy, plants and materials, the oceans, minerals, and environment, as well as man's cultural and recreational resources. It is expected to be completed this year. The information and ideas will be assembled in a comprehensive research plan for the consideration of the President. Close liaison is being maintained with the special Panel on Natural Resources of the Federal Council for Science and Technology.

Frank L. Campbell, associate editor of this *Journal,* worries about the supply of feature articles for the *Journal* and takes every opportunity, including this news section, to solicit manuscripts. He was also asked to worry about the contents of the *AIBS Bulletin* (American Institute of Biological Sciences) and served as chairman of an ad hoc committee to recommend improvements.

As secretary general of the Pacific Science Congress recently held in Honolulu, **Harold J. Coolidge** was busy for months preparing for the Congress, and finding ways and means to transport participants from the mainland, and from foreign countries, to Hawaii.

W. H. Larrimer organized and participated in a Symposium on the Ecological Consequences of the Use of Toxic Chemicals in Pest Control at the Pacific Science Congress.

NATIONAL BUREAU OF STANDARDS

The following talks have been given by members of the staff:

F. L. Alt: "Planning and Management of a Mathematical Research and Service Facility" at the Naval Research Reserve Seminar on Research Planning Management, Princeton University, August 25, and "Some New Developments in Automatic Language Translations" at the Association for Computing Machinery, Los Angeles, September 5-8; **L. M. Branscomb:** "Physics of the Negative Ions" at the Physics Colloquium, University of Washington, Seattle, August 23, and "Radiative Formation and Destruction of Ions" at the Fifth International Conference on Ionization Phenomena in Gases, Sonderpostam Deutsches Museum, Munich, August 28-September 1; **H. P. Broida:** "Double Wall Glass Dewars for Optical and Other Studies at Liquid Helium Temperatures" at the Fifth International Symposium on Free Radicals, Institute of Physical Chemistry, Uppsala, July 6-7; **R. D. Elbourn:** "Symbol Manipulation, A New Career for Computers" at the IRE Professional Group on Military Electronics, 5th National Military Electronics Conference, Shoreham Hotel, Washington, June 27; **H.P.R. Frederikse:** "The Properties of Electrons in Rutile" at the Gordon Research Conference on Solid State Studies of Ceramics, Meriden, N. H., July 31-August 4.

Also, **M. Greenspan:** "The Measurement of the Speed of Sound in the Ocean" at NATO, through the University of Pennsylvania, Imperial College, London, August 1; **J. L. Hague:** "Separations in Analysis" at the American Society for Testing Materials, Atlantic City, June 28; **C. M. Herzfeld:** "The Crystal Field Approximation" at the Institut Battelle, Centre de Recherche de Geneve, Carouge-Geneve, Switzerland, July 18; **R. B. Hobbs:** "International Standardization of ISO/TC 6" at the Technical Association of the Pulp and Paper Industry, Queen Elizabeth Hotel, Montreal, Canada, August 17; **A. G. McNish:** "The Science of Precise Measurement" to the Officers of the Naval Weapons Plant, Washington, July 10; **H. L. Logan:** "The Specimen for Use in Investigating the Stress-Corrosion Cracking of Metals at Elevated Temperatures" at the American Society for Testing Materials, Atlantic City, June 28.

Also, **S. B. Newman:** "Microscopy of the Color Phenomena in Polymer Failure" at the General Motors Research Laboratories, General Motors Technical Center, Warren, Mich., July 25; **C. H. Page:** "The Definition and Realization of the Electrical Units" at the National Bureau of Standards, Electronic Calibration Center, Boulder Laboratories, Boulder, Colo., August 21; **A. S. Posner:** "Hydrogen Bonding in Synthetic and Biological Apatites" at the Gordon Conference on Bone and Tooth Structure, Kimball Union Academy, Meriden, N. H.; **I. Rhodes:** "The Teacher's Role in the Age of Automation" at the Summer Institute of the National Science Foundation, College of William and Mary, Williamsburg, Va., July 31; **C. M. Sitterly:** "The Solar Spectrum" at the Department of Physics, University of Wisconsin, Madison, Wis., August 7.

Also, **W. J. Youden:** "Physical Measurements and Experiment Design" at the International Statistical Institute, Paris, September 5, and "Test Programs for the Statistical Evaluation of Materials" at the Centre National de la Recherche Scientifique, Paris, September 6; and **L. B. Leter:** "Temperature Dependence of Electron Emission in the Field Emission Region" before the Eighth Field Emission Symposium, Williams College, Williamstown, Mass., August 28-30.

The following talks were presented before the 18th International Congress of Pure and Applied Chemistry, Montreal, August 7-10: **G. T. Furukawa:** "Calorimetric Determination at the National Bureau of Standards of the Purity of IUPAC-59 Samples of Benzene"; **A. R. Glasgow,**

Jr.: "Purification, Controlled Contamination, and Partition of IUPAC Cryometric Benzene Samples"; **W. J. Hamer:** "Theoretical Electromotive Forces for Galvanic Cells Containing Molten Halides"; and **J. R. McNesby:** "Thermal Decomposition and Isomerization of Propyl and Isobutyl Radicals."

S. N. Alexander was moderator of the Session on Computer Technology, IRE Professional Group on Military Electronics, Fifth Military Electronics Conference, Washington, June 26-28.

F. R. Caldwell was chairman of a panel round table discussion on "Transient Temperature Measurements with Thermocouples in Missile and Space Applications" at the American Society for Testing Materials meeting in Atlantic City, June 29.

Charles M. Herzfeld and **W. A. Wildhack** have been appointed associate directors of NBS.

Floyd Buckley has been promoted to assistant chief of the Physical Chemistry Division.

Harry C. Allen, Jr., has been appointed chief of the Analytical and Inorganic Chemistry Division.

NAVAL RESEARCH LABORATORY

William A. Zisman, superintendent of the Chemical Division, received the National Award for 1961 from the American Society of Lubrication Engineers at its annual meeting in Philadelphia last April. This award was in recognition of Dr. Zisman's many contributions to a better understanding of lubrication theory.

At a meeting of an IUPAC committee in Montreal during the first week in August, Dr. Zisman was appointed secretary to the newly established International Commission on Colloid and Surface Chemistry, under the Physical Chemical Section of IUPAC.

Ronald E. Kagarise, head of the Spectroscopy Section, presented two papers at the annual symposium on Molecular Structure and Spectroscopy, held at the Ohio State University, Columbus, June 12-16.

Robert B. Fox, head of the Organic Synthesis Section, presented a paper before the symposium on Organic Nomenclature in Columbus, Ohio, July 29-31, sponsored by the National Academy of Science and the Air Force in connection with a meeting of the IUPAC Committee on Organic Nomenclature.

A comprehensive group of nine lectures on "Fracturing and Fracture Mechanics" is being given by **G. R. Irwin,** superintendent of the Mechanics Division, at the University of Illinois during 1961. The first three lectures were given in February. The second and third groups are planned for presentation the first week of October and the second week of November.

G. R. Irwin, Mechanics Division, and J. E. Strawley, Metallurgy Division, attended the meeting of the Deutscher Verband fur Materialprufung, in Wurzburg, Germany, on March 16-17, and presented a paper entitled "Progress in the Development of Crack Toughness Tests." They were invited to attend as representatives of ASTM. This was the first large post-World War II meeting of the organization. Nearly 600 members and guests of DVM attended, largely from West Germany, but also from 14 European countries. The theme of the meeting was "Fracture Phenomena and Fracture Testing for Structural Materials."

J. A. Krafft, Mechanics Division, will attend a conference on "Crack Propagation" at Cranfield, England, September 26-28. His paper for this conference is entitled "Effect of Dimensions on Fast Instability of Notched Sheets" by J. M. Krafft, A. M. Sullivan, and R. W. Boyle. Dr. Krafft's travel plans include visits to various laboratories in France, Germany, Belgium, and England.

USDA, WASHINGTON

Harold H. Shepard, chief of the Agricultural Chemicals Staff, Agricultural Stabilization and Conservation Service, served from March 3 to April 28 as research specialist on pesticides at the U. S. pavilion, International Agricultural Exhibition, Cairo, Egypt. In connection with this assignment, Dr. Shepard traveled some 2000 miles in Egypt to view agricultural practices and consult with Egyptian specialists, many of whom have received doctorates at universities in the United States.

On July 27, **Justus C. Ward** gave a talk before the Great Plains Agricultural Council at Bozeman, Mont., on "Problems in the Use of Chemicals." On August 3, he visited the Wildlife Research Laboratory, U. S. Fish & Wildlife Service, Denver, to learn about the pesticide-wildlife hazard evaluation project which is just getting started.

Hazel K. Stiebeling, director of the Institute of Home Economics, received the degrees of Doctor of Humane Letters from Bowling Green State University, on June 4, Doctor of Science from Carnegie Institute of Technology on June 13, and Doctor of Science from Drexel Institute of Technology on June 17.

Elbert L. Little, Jr., dendrologist, Forest Service, did field work in Alaska during May and June. He studied the variations and distribution of trees and collected specimens.

George W. Irving, Jr., Agricultural Research Service, spent the week of August 14 at Woods Hole, Mass., as a participant in the NAS-NRC-sponsored conference on Renewable Natural Resources. This meeting was part of a broad program to accumulate the information needed to respond to President Kennedy's request for a comprehensive study on research needed to make optimum use of resources in the decades ahead.

Dr. Irving's topic was "Substitution Crops." He discussed the use of agricultural resources for non-food, non-feed uses—an aspect of resource use that is often overshadowed by the better-known uses for agricultural products in foods and feeds.

Dorothy Nickerson, color technologist in the Cotton Division, Agricultural Marketing Service, received the Godlove Award of the Inter-Society Color Council on April 11, in recognition of her outstanding contributions to the knowledge of color in science, art, and industry. Miss Nickerson is the third person to receive the award. The award is a plastic prism in which a gold diffraction grating is embedded.

UNCLASSIFIED

Jerome Namias, chief of the Extended Forecast Section, Weather Bureau, accepted an invitation from the National University of Mexico to serve as a visiting professor at the Institute of Geophysics for two months this summer. He lectured on "Climatic Fluctuations Associated with Problems of Extended and Long-Range Weather Forecasting."

DEATHS

Harry A. Bright died at his home in Chevy Chase, Md., on May 22. He retired last year as chief of the Analytical Chemistry Section of the National Bureau of Standards, after nearly 47 years of service. Mr. Bright was a native of Reading, Pa. He received the bachelor's degree from Pennsylvania State College in 1912 and the master's degree from George Washington University in 1927. He joined the National Bureau of Standards in 1913, and was made chief of the Analyical Chemistry Section in 1936. He was regarded as one of the Nation's foremost authorities on the chemical analysis of metals and alloys, and was awarded a silver medal by the Department of Commerce in 1954 for meritorious service. He also received the American Society for Testing Materials award of merit and the Anachem Award of the Association of Analytical Chemists.

Gotthold Steiner, formerly in charge of nematology research in the U. S. Department of Agriculture, died August 21 at the age of 75. He was a native of Switzerland and was educated there, becoming an American citizen in 1927. Mr. Steiner joined the Department of Agriculture in 1921 and retired in 1956. Since retirement he had been living in Puerto Rico, where he was engaged in research at the University of Puerto Rico on tropical nematodes.

AFFILIATED SOCIETIES

We have tried to include not only the events scheduled for October, but also such news items as have accumulated since the May issue of the Journal. *Most affiliated societies will be resuming regular meetings this month, after a summer of reduced activity.*

American Institute of Electrical Engineers, Washington Section

May 9—Special meeting for presentation by the authors of papers submitted in the annual competition for awards and certificates.

May 16—Ladies night, the final meeting of the year, featured a talk by Miriam Ottenberg of the *Evening Star* on "Investigative Reporting."

September 11—Special meeting on "Space Communications," with a panel under Edward W. Allen, FCC, as moderator, consisting of the following: John Pierce, Bell Telephone Laboratories; Elmer W. Engstrom, RCA; Herbert Trotter, Jr. General Telephone and Electronics Labatories; and Richard P. Gifford, General Electric.

American Society for Metals, Washington Chapter

October 9—A non-technical meeting, the annual "Quench and Draw" party.

American Society of Civil Engineers, National Capital Section

April 25—Luncheon meeting, at which Bruce G. Davis discussed the role of the Bureau of Reclamation in development of the nation's water resources, the origin of the Bureau, its operation, and current problems.

May 9—Election of officers, and a report by George H. Hickox on a program for increasing emphasis on civil engineering and the work of the Joint Board. Presentation of annual student chapter awards to Donald Evick, GWU; Robert Meyer, Catholic U., and Karl Lewis, Howard U.

May 23—Final luncheon meeting of the year, at which Col. John U. Allen and members of his staff presented an up-to-date summary of the progress and results of the comprehensive Corps of Engineers study of the Potomac Basin.

June 3—Tour of the Southwest Redevelopment Area, conducted by the chief engineer, James E. Linde, including town houses, police and fire stations, apartments, and new market center.

September 12—First dinner meeting of the new season. Capt. Deane E. Carberry, Bureau of Yards and Docks, spoke on "Castles in Spain," the significance today of the eight-year military construction program in Spain.

September 26—Maj. Gen. A. M. Minton described the emphasis placed by the Air Force on the professional status of its civil engineers.

October 10—Regular dinner meeting, Cosmos Club.

October 24—Monthly luncheon meeting, YWCA.

American Society of Mechanical Engineers, Washington Section

April 27—Discussions by Henry E. Frankel on "Down to Earth Space Problems," and by Lawrence M. Kushner on "Imperfections and Mechanical Properties of Single Crystals."

May 11—Chester M. Sinnett, director of product engineering, RCA, spoke on "Creativity in Management."

May 25—Harry George, Martin Company, spoke on "Manufacturing Planning," the relationship of this planning to engineering and product design.

June 1—Symposium on "Fuel Trends and Economic Patterns," covering resources, methods of exploitation, uses and economies, in four areas: coal, Myles E. Robinson, National Coal Association; oil, C. W. Lutz, Gulf Oil Corporation; gas, Curtiss Morris, American Gas Association; nuclear, Andrew W. Kramer, *Atomics Magazine*.

September 28—John de S. Coutinho, Polytechnic Institute of Brooklyn, spoke on "Reliability Control—Fact or Fiction," a consideration of the problem in aero-space equipment.

Botanical Society of Washington

The Society had no formal meetings, but initiated for the first time in a number of years several field trips, one to the Great Falls area, one to Battle Creek Swamp and one to a hemlock preserve area south of Scientists Cliffs.

October 3—First regular meeting of the year.

Chemical Society of Washington

October 12—Three concurrent speakers at 5 p.m., before dinner: "Organo-Derivatives of the Transition Metals," by F. G. A. Stone, Harvard University; "Equilbrium Polymerization and Copolymerization," by Arthur V. Tobolsky, Princeton University; "Non-Covalent Bonds in Protein Structure," by Irving M. Klotz, Northwestern University. Following cocktails and dinner, the speaker of the evening will be Glenn T. Seaborg, chairman of the Atomic Energy Commission, on "The Newest Synthetic Elements," at 8:15 p.m. Catholic University Chemistry Building.

November 9—Panel discussion on "The Chemical Origin of Life" by Philip H. Abelson, Geophysical Laboratory, and Sidney W. Fox, Oceanographic Institute, Florida State University. Walter Reed, 8:15 p.m. Annual election of officers.

Columbia Historical Society

October 19—Regular monthly meeting, at Providence Hospital, where Philip Caulfield, chief of staff, will speak on "A Century of History at Providence."

Entomological Society of Washington

June 7—In cooperation with the Insecticide Society of Washington, the group held a "Space Age" picnic at Log Lodge, Agricultural Research Center, Beltsville.

October 5—Regular meeting, Room 43, Natural History Museum. David C. M. Manson will speak on "Some New Zealand Insects."

Geological Society of Washington

April 26—The 823rd meeting heard papers by K. J. Murata and D. H. Richter on "Basaltic Differentiation as Shown in Recent Kilauea Eruptions"; Irving Friedman on "Trends in Water and Deuterium Content of Pumices from the 1959 Kilauea Eruptions"; and D. Foster Hewett on "Distribution of Manganese."

September 27—At the first meeting of the new season, Isidore Zietz and Kenneth G. Books spoke on "Remanent Magnetism and Aeromagnetic Interpretation of the Bearpaw Mts. Area, Montana"; Paul M. Johnston on "Geology of the Greater Washington Area"; and Bruce R. Doe on "Geothermometry of the Sulfide Ores at Balmat, New York."

Helminthological Society of Washington

May 20—Annual picnic for members, family, and friends.

October 20—51st anniversary meeting, Officers' Club, Walter Reed Army Medical Center. Dinner at 7:00 p.m., after which Leon Rosen, NIH, will speak on "Eosinophilic Meningitis in the Pacific Area," and George Wharton, Ohio State, on "Why Study Systematics?" Reservations are limited to 125 persons.

Insecticide Society of Washington

May 17—"Tropical Fruit Fly Population Sterilization Research in Mexico, Hawaii and the Western Pacific," L. D. Christenson, ARS; and "Comments on Possibilities of Applying the Sterile Male Principle to the Control of Other Insects," by E. F. Knipling, ARS. Annual election of officers, and social hour.

Institute of Radio Engineers, Washington Section

With a membership of 3,500 and some 20 professional groups active, the Section has one of the more comprehensive programs in the Washington area. Beginning with the September issue, there is a new and enlarged publication known as *The Washington Bulletin*, under the editorship of George C. Ruehl. This seems to be one more step in the gradually increasing number of society and chapter journals put out by affiliated societies.

September 11—General section meeting, featuring a panel discussion of "Space Communications," under Edward W. Allen, FCC, details of which are noted in the announcements of the American Institute of Electrical Engineers, above.

September 12, 14, 25—Technical meetings.

September 27—Gala reception and cocktail party, main ballroom, Presidential Arms.

October 16—Regular meeting under the sponsorship of the Professional Group on Engineering Management, concerned with "Stock Analysis."

The following technical meetings will be held in October:

October 2—Instrumentation.

October 4—Electronic Computers.

October 10—Microwave Theory and Techniques.

October 17—Antennas and Propagation; Radio Frequency Interference.

October 18—Nuclear Science.

October 23—Engineering Management.

October 25-26—Conference on Reliability and Quality Control, Department of Interior Auditorium.

October 26-28—Annual technical meeting of the Professional Group on Electron Devices, Sheraton Park Hotel.

Medical Society of the District of Columbia

May 22—The Society, in joint sponsorship with the Metropolitan Washington Board of Trade, presented a testimonial luncheon under the "Health-USA" Awards program to James A. Shannon, director of NIH, and William B. Walsh, founder and president of Project "HOPE." This activity was initiated in 1958 and has become an outstanding recognition of individuals "who have contributed in a statesmanlike fashion to the health needs of our country."

Philosophical Society of Washington

October 13—1512th meeting. Sir Harold Jeffreys will speak on "The Strength of the Earth," at the Powell Auditorium, 8:15 p.m.

Society for Experimental Biology and Medicine, District of Columbia Section

October 5—First meeting of the season, Gorman Auditorium, Georgetown University Medical Center, 38th St. and Reservoir Rd.

Society of American Bacteriologists, Washington Branch

October 24—Regular meeting, including two papers: "Ecology of Rocky Mountain Spotted Fever: Recent Studies," by F. Marilyn Bozeman, Walter Reed Institute of Research; and "Nitrate Reducing Streptococci," by P. P. Williams and C. W. Langston, USDA.

Society of American Foresters, Washington Section

October 19—First meeting of the fall season, YWCA building.

THE BROWNSTONE TOWER

For scientific and social purposes American scientific organizations have evolved along two lines: (1) groups covering natural s c i e n c e as a w h o l e (represented by the American Association for the Advancement of Science and national, s t a t e, and municipal academies of science); and (2) groups concerned with various subdivisions of natural science (represented by national, regional, or local scientific societies). Among the latter are the professional societies, the so-called trade unions of science.

The Washington Academy of Sciences is one of more than 50 state and municipal academies that tries to devise and carry on programs peculiarly suited to its area. These programs differ greatly in different academies, depending not only on local needs but on various historical and human factors. On the whole our state and municipal academies encourage rather than carry on or support research, put much effort into the improvement of scientific education and the identification and development of science talent, provide outlets for the publication of scientific research, and furnish opportunity for scientists in different fields to meet and discuss interdisciplinary problems. Through the activities of their substantive sections they may provide the equivalent of regional or local scientific societies.

Since the officers and board of the Washington Academy are eager to improve its services in kind, quality, and quantity, it should be helpful to us to know what other academies are doing and how they do it. In the April issue of the *Journal* we reported on the California Academy of Sciences. Now I should like to give you the results of my visit of February 3, 1961, to the New York Academy of Sciences at its headquarters, 2 East 63rd St., New York City. For brevity I shall call it "the Academy."

The Academy occupies what was once an elegant four-story town house, which it has outgrown. Upon entering the reception hall my attention was attracted by large plastic numerals over a door. They told the visitor that the membership of the Academy as of that day was 15,222. I next noticed a framed architect's drawing, hanging in a conspicuous place, of a modern 25-story office building. This was captioned "Proposed Science Center Building for the New York Academy of Sciences," which would have its own new nine-story auditorium building attached to the Center Building. Later I was given a descrip-

tive pamphlet on this building project. It is intended, of course, that offices in the larger building will be rented by scientific or science-related organizations and that income from rents will help to pay for the cost of this ambitious project. The site has not yet been purchased, but it is desired to locate the Center within walking distance of the Rockefeller Institute and the New York Hospital—Cornell University Medical School.

The Executive Director of the Academy, Mrs. Eunice Thomas Miner, was not free to see me, so I talked to a young man who was employed in the distribution of the Academy's publications. I wanted to know whether the Academy should be regarded as a municipal academy or a state academy. "Neither," he said, "the Academy is a national organization that happens to be located in New York City." Its 1959 Constitution states that "the center of its activities shall be in the City of New York," implying that there are no geographical limits to its jurisdiction. This is true in practice because more than 75 per cent of the members reside in the 49 states outside of New York and in 66 foreign countries.

Although the Academy is known nationally and internationally for its publication of the proceedings of scientific conferences that it sponsors, it also has a local program of meetings in its own building—monthly meetings of local members of its four sections and 10 divisions. Some of the papers presented at these meetings are published in a monthly periodical called "Transactions of the New York Academy of Sciences." The conference proceedings, or symposia, are published separately as paper-covered monographs, but for purposes of citation are part of a periodical called "Annals of the New York Academy of Sciences," the paging running consecutively through a "volume" of several monographs. There are also a few books called "Special Publications" and a long series of reports beginning in 1919 on the Academy's "Scientific Survey of Porto Rico and the Virgin Islands."

It is obvious that the Academy is primarily an organization for publishing and distributing scientific papers presented at symposia, which it arranges and supports at a nearby hotel, pending the building of its own meeting facilities. It might just as well be the New York office of the American Association for the Advancement of Science specializing in the production and distribution of symposium monographs. No other organization in the United States, not even the AAAS itself, competes with the Academy in its special field of publication.

The ability of the Academy to recruit members at $25 per person per year and hold them resides in its capacity to give each member the current monographs he wants. If the member is medically oriented, he can easily want several monographs per year, the total list price of which would exceed $25. And, in addition the member receives the monthly program and the *Transactions*. If the member does not get his money's worth, it is his own fault.

The biological and medical sciences predominate in the Academy. Of the 21 monographs scheduled for publication in 1961 all but three of four are in the life sciences. This predominance is reflected in the specialties of the members. For example, I find the following distribution among the members elected in December 1959: M.D.'s 34; other medical scientists 20; other biologists 5; chemists, usually organic, 12; one physicist and a "pedagogue"; total 73. Thus at least 80 per cent of these new members were on the biological side and most of them were either M.D.'s or were working in the medical sciences.

Regarding qualifications for membership, "Persons of scientific training, having been at any time engaged in scientific work or otherwise in the advancement of science, shall be eligible for Active Membership when nominated in writing to the Scientific Council by two members [having] full membership privileges." Recruiting of new members is done systematically by mail.

Like the AAAS, the Academy elevates its genuine scientists to fellowship to which a member is eligible after having been an active member for one year and having "attained outstanding recognition for scientific achievement or for the promotion of science." A Fellow of the Academy is also an Active Member and pays the same dues as an active member. Other classes of membership are: "student," $5 annually; "sustaining," $50 annually; "life," $300; "patron," $1000; "benefactor," $5,000. In addition there are corporation members and honorary life members.

The income of the Academy for fiscal year 1959 was almost $900,000. About $339,000 came from dues and $354,000 from sale of publications. Contributions amounted to about $172,000. Most of this money, about $480,000, was spent for production and distribution of publications. Approximately $22,500 was spent for "membership expansion," requiring more than 900 new members to be obtained in 1959 to make the expenditure pay off!

The Academy is governed by a Board of Trustees concerned with finances, budget, and audits, and by a Scientific Council under which operate the following committees: Executive, Conference Organization, Educational Advisory, Fellows and Honorary Life Members, Nominating, Publications and Awards, and Section Activities.

The Academy is structured as follows (two divisions have recently been added):

Section of Biological and Medical Sciences
Division of Anthropology
Division of Instrumentation

Division of Microbiology
Division of Psychology
Section of Chemical Sciences
Division of Biochemistry
Section of Geological Sciences
Division of Oceanography and Meteorology
Section of Physical Sciences
Division of Engineering
Division of Nuclear Physics

As I have not attended a local meeting of any of these sections and divisions, I am not able to comment on their programs and connections with science in the metropolitan area. Also I am not informed about the activities of the Educational Advisory Committee, which is expected "to advise and assist accredited educational groups, upon request, on academic problems pertaining to science education, especially at the secondary school level."

What a tremendous difference there is between the New York Academy and the California Academy; the former primarily a medium of communication for medical scientists; the latter primarily an educator of the public in natural history and astronomy through popular publications and exhibits, backed by first-class research. Neither academy bears much resemblence to the Washington Academy; but both teach us not to be exclusive and to do more for our members and the lay public than we are now doing.

—Frank L. Campbell

ACADEMY ACTIVITIES

MAY BOARD MEETING

The Board of Managers held its 538th meeting on May 2 at the National Academy of Sciences, with President Abelson presiding. The minutes of the 537th meeting were approved as previously circulated.

Dr. Abelson announced that Joseph M. Caldwell had replaced Douglas E. Parsons as delegate of the American Society of Civil Engineers. He also announced that Raymond J. Seeger was resigning as chairman of the Committee on Science Education, since he expected to spend the next year in advanced studies at Oxford University under an NSF fellowship.

Dr. Frenkiel reported on the Meeting Committee's recent experience in stimulating interest in, and attendance at, the Academy's lecture meetings. He stated that the Committee plans to continue the "third Thursday" regular meetings, generally with speakers from the metropolitan area, and that these would normally be given in the John Wesley Powell Auditorium. The suggestions considered for these meetings were reviews and discussions of fields and disciplines which are currently showing interaction, and perhaps those in which interaction should be generated. A second type of meeting, characterized by the special meeting recently held at Carnegie Auditorium and addressed by Herman Kahn, Marquis W. Childs, and Frank T. McClure, may be set additionally for once a month; it is anticipated that such meetings would require a larger auditorium than the Powell Auditorium. He said that the Committee had not intended to sort out the meetings by subject matter, to differentiate which would be regular or special meetings. Dr. Frenkiel then discussed the program for the May 18 regular meeting, and ideas for subsequent meetings.

For the Membership Committee, Dr. Robbins presented the names of three nominees for First Reading.

Dr. Robbins also announced the names of Membership Committee Panel chairmen, as follows: Agricultural Sciences, Erwin L. LeClerg (USDA); Chemistry, Howard W. Bond (NCI); Earth Sciences, Victor T. Stringfield (Geological Survey); General Biology, Harold E. Finley (Howard U); Mathematical Sciences, F. Joachim Weyl (ONR); Medical Sciences, Ross C. MacCardle (NIH); and Physics and Astronomy, Richard K. Cook (NBS). She hoped that a panel on engineering sciences could be completed before the fall session.

Dr. Campbell reported that the Policy and Planning Committee had endorsed a letter that the Membership Committee proposed to send to delegates from affiliated societies, concerning stimulation of membership in the Academy (see also under New Business, below). Secondly, he referred to recent Committee discussions concerning the need for another joint directory of the Academy and affiliated societies. Dr. Abelson indicated that at a dinner meeting held some time ago by the Policy and Planning Committee, representatives of the affiliated societies expressed a reasonably positive interest in having a joint directory; but that the major problem was to find someone who was willing and able to take charge of preparing the directory. There was considerable discussion of possible candidates for the job, but no definite conclusions were reached.

Under New Business, the Board considered some draft material distributed by Dr. Robbins for the Membership Committee. This comprised a proposed letter to the delegates of affiliated societies, urging their cooperation in nominating eligible scientists for membership in the Academy; a statement of procedures used by Membership Committee Panels in considering new members for election; and an extract from the Bylaws concerning membership. (Essentially the same material is included elsewhere in this issue of the *Journal*, in the story entitled, "Academy Membership Increase Urged.") After considerable discussion of the distinction between scientific attainment and original research, the Committee's report was unanimously approved.

Dr. Seeger, who had come in late, reported for the Committee on Science Education. He indi-

cated that the Meyer Foundation had withdrawn its financial support of *The Reporter*, monthly publication of the Joint Board. On the happier side, he reported that NSF had provided a $27,000 grant for extension of the projects that have been caried on for the past two years. He indicated, however, that because of a reduction in the amount from what had been requested, and because of changes brought about by the projects themselves, the time had come to shift the course and objectives of the program. He discussed the shifts in emphasis in some detail.

Following the second reading of their names, the following persons were elected to membership in the Academy: James B. Edson, Roland E. Florin, Harry A. Fowells, Robert E. Hardenburg, Fred R. Kotter, Jacob Mazur, Eugene M. Rankin, Robert L. Schoeneman, Paul A. Siple, and Mary E. Warga.

JUNE BOARD MEETING

The Board of Managers held its 539th meeting on June 6 at the National Academy of Sciences, with Secretary Specht presiding in the absence of both the president and the president-elect. The minutes of the 538th meeting were approved as previously circulated.

Dr. Specht announced that President Abelson had appointed John K. Taylor to head the Committee on Science Education in view of the resignation of Raymond J. Seeger. Also, Dr. Seeger's place as a member of the Committee has been taken by Churchill Eisenhart, and Robert E. Hobbs has been reappointed; the terms of Drs. Eisenhart and Hobbs will extend through June, 1964. For the Meetings Committee, Dr. Frenkiel spoke briefly regarding the successful meetings of the current season, and pointed out that much of the successful outcome depends upon very active publicity efforts, particularly the mailing of notices to the membership of other societies especially interested in the field. Responding to a comment on conflicts between some of the meeting dates and other society programs, he pointed out that some of the most interesting speakers are busy people whose schedules permit little rearrangement, and some of the meeting dates had to be accommodated to their commitments.

Dr. Frenkiel also discussed program possibilities for the fall meetings of the Academy; one of these may be a follow-up of the recent panel discussion on science fairs. In consequence of the ensuing discussion, Dr. Frenkiel moved that formal action be taken to appoint a committee whose responsibility would be the improvement of the conduct of science fairs in the Washington area; the motion was approved.

For the Membership Committee, Dr. Robbins presented the names of eight nominees for First Reading. Dr. Robbins pointed out that these nominees would not ordinarily become elected until the October meeting, and suggested that, since the interval between first and second readings is permitted to be only one week, the Board should consider the election of the nominees a week hence (i.e., in the absence of dissident votes received within the following week, the nominees would be considered elected). On motion of Dr. Frenkiel, the Board directed the secretary to cast a unanimous vote for the election of these nominees, subsequent to the determination of tacit approval.

Alfred E. Brown, the Board of Managers' liaison with the Board of Trade of Metropolitan Washington, addressed the Board by invitation on the organization of the Board of Trade's Science Bureau. Among its future activities, the Bureau expects to prepare a brochure listing the science resources of the Washington area. Also, it will undertake a comprehensive study of educational resources in this area, particularly in graduate science education.

For the Policy and Planning Committee, Dr. Campbell reported that the Committee had recommended appointment of an *ad hoc* committee to study the feasibility of preparing a joint directory of the Academy and affiliated societies. If this committee recommends undertaking the task and the Board approves, another committee would be appointed to do the job.

Dr. Campbell also reported that the Committee did not support an application for affiliation from the National Capital Astronomers, a society composed largely of amateurs, on the same basis as that applied to local professional societies. However, the Committee is not ready to make a positive recommendation, which might involve change in structure of the Academy and of its categories of membership.

The Committee has been giving consideration to subjects on which the Academy might take a public position, through meetings or editorials in the *Journal*—i.e., civil defense, administration of the National Zoo, providing for science in the National Cultural Center, the Cooper Bill to police the use of laboratory animals, and scientific intelligence.

In connection with activities of the Committee on Science Education, Mr. Braaten noted that Dr. Schubert had requested a donation of $200 to support a summer research program for senior high school students. It was pointed out that NSF will match such funds by an equal amount. Dr. Brombacher moved that the request be approved, with the suggestion that the AAAS be asked whether its grant monies, normally credited to the Academy for research support, could be made available for this purpose. The motion was approved.

For the Committee on Encouragement of Science Talent, Dr. Brenner stated that the Junior Academy of Science had issued 500 membership cards. Consideration is being given to changing the nature of the Junior Academy's spring banquet and awards ceremony, so that it

will not be run in competition with a regular lecture meeting of the Senior Academy.

Dr. Foote led a discussion of the Academy's position as concerns support of the National Zoo. Dr. Frenkiel suggested that the topic might be discussed at a fall meeting of the Academy.

Following the second reading of their names, the following persons were elected to membership in the Academy: Abolghassem Ghaffari, Jack C. Smith, and Thomas G. Ward.

Dr. Foote addressed the Board on the organization and functions of the Ohio and Virginia Academies of Science.

SCIENCE AND DEVELOPMENT

The original "Space Camera" was presented to the Smithsonian Institution by the General Electric Company on February 28. This is the first camera to take motion pictures of the earth from an altitude of more than 300 miles. It was installed in a small data capsule in the nose cone of a U. S. Air Force Thor rocket that was launched from Cape Canaveral, Fla., on May 12, 1959. The rocket travelled 15,000 miles southeast over the Atlantic Missile Range in 15 minutes. The capsule was ejected near the predicted impact point and recovered from the sea by a recovery ship. The camera had to be structurally designed to protect the exposed film during re-entry into the earth's atmosphere, deceleration, water impact, and flotation. A significant result of this test flight was proof that ordinary photographic emulsions can be used in unshielded cameras at altitudes of 300 miles without deterioration from radiation, even though the Van Allen belt extends down to about 200 miles in the latitude where the test took place.

A revised text of the International Temperature Scale of 1948 was adopted by the 11th General Conference on Weights and Measures at the October 1960 meeting of the General Conference. This temperature scale was originally adopted in 1927. It defined 6 fixed points and formulas establishing the relationship between temperature and the indications instruments calibrated by means of the fixed points. The fixed points were the oxygen point (−182.97°C), the ice point (0.000° C), the steam point (100.000° C), the sulfur point (444.6° C), and the freezing points of silver (960.5° C) and gold (1063° C). Because of new experimental data the Scale was revised in 1948. The recent revision was prepared by the National Bureau of Standards in cooperation with other members of the Advisory Committee on Thermometry. In this revision the easily-reproduced triple point of water (0.01° C) replaced the ice point as a fixed point on the scale. Also, the name was changed to International Practical Temperature Scale.

A collection of birds that may include forms new to science has been made in the area around the headwaters of the Rio Seteganti and the high mountain Cerro Pirre in Darien, Panama, near the Colombian border. The expedition was conducted by Alexander Wetmore, retired secretary of the Smithsonian Institution, under the auspices of the Gorgas Memorial Laboratory of Panama City. The party was flown in by helicopters and landed on hard ground near the edge of swamps. The area is a dense jungle that had been abandoned by humans since the closing of a gold mine there about 50 years ago. According to Dr. Wetmore, bird life in that part of Darien resembles the South American avifauna more than the Central American.

New agricultural weather services will soon be provided in eight broad areas of the United States through a $758,000 appropriation to the Weather Bureau. The new program will provide frequent and timely agricultural forecasts by means of a teletypewriter circuit covering each area. Local radio and television stations, as well as farm publications and newspapers, will be connected to the forecast office by the network. The forecasts will enable farmers to determine the best times for planting, spraying, harvesting, and other vital operations. Besides three daily special agricultural weather forecasts and a daily "Farm Weather Summary," the teleprinter hookup will also give rapid dissemination of fire-weather forecasts and agricultural interpretations of the 5-day and 30-day weather outlooks, along with other information of value to agricultural interests.

Progress toward agreement on the use of a compromise system for transliterating Russian (Cyrillic) characters into the Latin alphabet was achieved at a meeting of representatives of scientific and engineering societies, editors, publishers, librarians, and Government agencies held here on July 14. The meeting was called by AAAS at the request of NSF, to discuss the adoption of a single, uniform transliteration system for Russian to English. The compromise system, tentatively designated the "AAAS transliteration system," combines features of various systems now in use so that transliteration of Cyrillic to Latin alphabets may be standardized. An important consideration in adoption of the compromise system was that it could be typewritten with the minimum use of diacritical marks. Systems considered in effecting the compromise were the Board of Geographic Names (BGN) System, the British Standards Institution (BSI) System, the Library of Congress-American Library Association (LC-ALA) System, and the International Standardization Organization (ISO) System.

The Library of Congress has initiated a survey of the scientific and technical serial publications of the world. Purpose of the survey, under the direction of C. M. Gottschalk, is the compilation of a bibliography of sources on scientific and

technical serials and, based on those sources, a calculation of the number of current periodicals of the world by country and by subject. At the conclusion of the survey, financed by an NSF grant, a report will be published, along with an international bibliography of sources consulted.

The first known underwater analyses of the sea's naturally-occurring radioactive sources have been made by the Navy with a new ultra-sensitive radiation measuring device recently tested a mile deep under the Caribbean Sea. Called DUNC (Deep Underwater Nuclear Counting) the device is so sensitive that it can detect one atom of radium in a billion billion molecules of water. It was designed by the Nuclear Physics Division of the Naval Ordnance Laboratory, to collect detailed data on the presence and intensity of undersea radiation sources in their natural habitat. Especially adapted for shipboard operation, DUNC instantaneously renders data formerly obtainable only by collecting samples of the sea and subjecting them to analysis in a laboratory.

A gamma irradiation facility will be designed for radiation research studies on the University of Maryland campus. The heart of the new project will be a cylinder, one foot high and three inches in diameter, which will contain 3,000 curies of cobalt 60. Gamma radiation from this source will be equivalent to about seven pounds of radium. Targets to be irradiated will be placed in a shielded room located below ground level. The source will then be lowered into the room to expose the targets. Upon withdrawal of the source into its 5,000 pound lead shield, the targets will be removed and analyzed.

On June 14, Commerce Secretary Luther H. Hodges broke ground for the new National Bureau of Standards laboratories at Gaithersburg, Md. The ceremony signaled the initial construction phase for a 20-building, $104 million research facility which will permit complete relocation of the Bureau from its present location on Connecticut Avenue to the 555-acre site in Montgomery County.